An Analysis of the Nuclear Data Libraries Impact on the Criticality Computations Performed using Monte Carlo Codes

ELENA DANIELA N. GUGIU

INSTITUTE for NUCLEAR RESEARCH, Pitesti, ROMANIA

The major aim of the work is a sensitivity analysis related to the impact of the different nuclear data libraries on the criticality calculations performed for various CANDU fuel projects, and on the simulations related to the replacement of the original stainless steel adjuster rods by cobalt rods in CANDU 6 reactor core.

The criticality calculations and the void effect estimations for various CANDU fuel types are performed using the Monte Carlo transport codes MCNP5 and MONTEBURNS 2.0. The simulations are performed for the actual, detailed geometry and material composition of the fuel bundles and reactivity devices. The computations are performed for fresh fuel, and for various burnup point values, as well. Some comparisons with deterministic and probabilistic code results (involving WIMS library) are also presented.

The analysis of the results show that: 1) different neutron cross-section releases for the same isotope could induce changes in the k-infinity value; 2) MCNP/ WIMS calculations performed for various burnup values point out the impact of the pseudo-fission products library (WIMS) on k-infinity values; 3) the accuracy of the MONTEBURNS criticality computations is influenced by the values of the isotope importance fractions, and especially by the cross-section libraries for the fission and pseudo-fission products.

The computations related to the replacement of the stainless steel adjuster rods by cobalt rods are also performed using MCNP5 and MONTEBURNS codes.

The impact of the cross-section temperature dependency and of the neutron capture cross-section to metastable states on the neutronics simulations, as well as on the Cobalt dose and heating evaluations is also investigated in the present work. Uncertainty effects and their limitations are also analyzed.

Email: danagugiu@yahoo.com